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INTERNATIONAL COLLUSIVE ACTION IN WORLD MARKETS FOR
NONFUEL MINERALS: MARKET STRUCTURE AND
METHODS OF MARKETING CONTROL

by

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FOREWORD

In 1973 and 1974 the Organization of Petroleum Exporting Countries (OPEC) has had remarkable success in raising taxes on vertically integrated petroleum firms. These firms have been able to pass on the increases to consumers of refined products. Such actions have raised questions about the extent to which existing or potential associations of countries producing nonfuel commodities might use these same methods.

As part of a Department of State analysis of the situation, the Department's Bureau of Intelligence and Research, Office of Economic Research and Analysis (INR/REC), asked INR consultant Professor Raymond F. Mikesell to undertake this study. Professor Mikesell, associated with the Department of Economics at the University of Oregon, is noted for his studies of the economic aspects of the mineral industries.

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SUMMARY

OPEC members have employed collusive action in the raising of taxes on vertically integrated petroleum firms that have been able to pass on the increased taxes to consumers of the refined products. This approach has made it unnecessary for OPEC members to reach agreements on production or export quotas. In addition to vertical integration of the petroleum companies, OPEC's success may be attributed to a high concentration of world petroleum production in the OPEC countries, an inelastic demand for the product, and a higher rate of growth than anticipated in world demand for petroleum.

These conditions are not approximated in any of the nonfuel mineral industries. Of these, the bauxite industry comes closest to meeting the criteria for OPEC-type market control because: (1) the major producing firms are vertically integrated, and (2) a high proportion of the world's supply of bauxite is produced by members of the newly formed International Bauxite Association (IBA). However, there are substitutes for aluminum in many areas; aluminum scrap could supply a substantial proportion of the demand; and IBA members are unlikely to unite on an aggressive program for achieving a substantial increase in the price of bauxite. Moreover, the price of bauxite is only a small fraction of the value of aluminum, whereas two barrels of crude oil have approximately the same value as one barrel of the refined product.

Imperfect competition and product differentiation in ores and concentrates facilitate market control by international firms with worldwide marketing organizations and established relations with purchasers which are based on confidence in product quality and the ability to meet delivery schedules under contracts. These conditions may enable international mining firms to pass on increased taxes imposed by host governments to the consumers of their products. Nationalized mining enterprises, however, lack these prerequisites for market control and usually must compete on a price basis.

Agreements among members of governmental producers' associations on minimum prices in sales contracts are

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likely to break down as soon as some members begin accumulating surpluses. Members' agreements on export quotas have proved exceedingly difficult to reach and to enforce, especially without the cooperation of consumer countries. Although such agreements might operate successfully in the short run, each association member is anxious to expand its productive capacity, and the negotiation of a workable formula for allocating world market shares presents almost insuperable difficulties. Agreements on export quotas are likely to succeed, if at all, only in response to declining prices arising from increases in world supply relative to demand.

For minerals traded on commodity exchanges, market control is more readily achieved by means of buffer stock operations. If large stock accumulations are to be avoided, however, a buffer stock device can be used only to reduce price fluctuations above and below predicted long-term equilibrium levels.

The United States is now or may become dependent on foreign supplies for some minerals over the next decade. Of the principal nonfuel minerals, only bauxite and copper appear to be candidates for collusive action which might result in substantial raising of world prices. This judgment is premised in part on: (1) the availability of supplies at reasonable prices of several important nonfuel minerals from Canada, and (2) the unlikely prospect of collusive action among major world producers with widely differing political and economic orientation, such as the major producers of chromium. In any case, collusive action for raising world prices of nonfuel minerals is not likely to be effective for more than 2 years from the time of its initiation. Potentially harmful effects of such actions on the US economy can be avoided by adequate stockpiles.

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NONFUEL MINERALS: MARKET STRUCTURE AND
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INTRODUCTION

The ability of an association of producers of a raw material to raise the price of that material by means of collusive action and to sustain the increase for a year or more depends on a number of factors, including:

- (a) the share of the world market supplied by members of the association;
- (b) the elasticity of world demand for the commodity;
- (c) the elasticity of the supply of the commodity controlled by nonmembers, and of substitutes for the commodity;
- (d) the structure of the world market for the commodity;
- (e) the financial positions of the members of the association; and
- (f) the cohesiveness and discipline of the members of the association for carrying out a joint policy.

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A full assessment of these factors with respect to each of the major nonfuel minerals would require a series of comprehensive industry studies. This study explores alternative methods of controlling world prices of selected nonfuel minerals by producer associations.

The feasibility of any mechanism for controlling prices through collusive action depends on the factors relating to the world market listed above. For example, it may be difficult for the members of an existing or potential producers' association in a commodity to establish and implement production or export quotas; but the association might be successful in achieving its price objectives by some other means, such as raising taxes on private international firms producing the commodity in the territories of the association members.

To cite another example, where a substantial proportion of world trade in a commodity takes place on commodity exchanges or where the prices used in contracts for the sale of the commodity are tied to quotations on international commodity exchanges, the most suitable method for controlling international prices is likely to involve some form of buffer stock arrangement designed to control directly prices on the commodity exchanges.

MARKET STRUCTURE AND THE EQUILIBRIUM PRICE

Most of the important nonfuel minerals, including copper, lead, tin, zinc, silver, and mercury, are traded on the commodity exchanges in London, New York, and certain other financial centers. Other important commodities, such as steel, are not traded on the commodity exchanges. Even where minerals are traded on commodity exchanges, most of the transactions do not go through the exchanges but are conducted by contracts between buyers and sellers. In some cases, transactions may take the form of transfers from the producing company to its affiliates that process the commodity or use it as a minor input in the production of some other commodity, as is the case with chromium or manganese in the production of steel.

Frequently prices used in the contracts depart substantially from the prices quoted on the commodity exchanges. This is true, for example, in the case of contracts for the sale of copper in the United States. Producers' prices for

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copper are frequently above or below copper quotations on the New York Commodity Exchange (COMEX) or the London Metal Exchange (LME). Producers' prices for copper and other metals often are determined by tacit agreement among producers, or they may be subject to governmental control.

In the case of mineral ores or partially processed ores such as concentrates or alumina, trading does not take place at all on the organized exchanges. Prices are governed by negotiations between producers and purchasers, or, in the case of vertically integrated industries, transfer prices between producers and downstream affiliates may be determined in accordance with the objectives of intracorporate accounting.

In some cases, contracts for semiprocessed minerals such as copper concentrates may be governed by price quotations for the refined product on the commodity exchanges. This is true for most of the copper concentrates produced outside the United States. For bauxite and iron ore, the price of raw materials is generally not related to the price of the finished product.

Where a raw material is produced by a private international firm and where royalties and income taxes levied by the host government are calculated on the basis of the price of the product, the absence of an international market price creates a problem as to what price to use for tax purposes. For copper produced by international mining firms in developing countries, the LME price is generally used as a basis for calculating royalties and income taxes. In the case of bauxite it has been necessary for the host government and the producing firm to reach some agreement regarding the price to be used as a basis for taxation. In Venezuela an elaborate system of determining the "reference price" for iron ore has been used as a basis for calculating taxes on producers of iron ore in that country.¹⁷

¹⁷ For a discussion of the system of establishing prices of iron ore for tax purposes in Venezuela, see Henry Gomez, "Venezuela's Iron Ore Industry," in Foreign Investment in the Petroleum and Mineral Industries, Raymond F. Mikesell and Associates, Baltimore: Johns Hopkins Press for Resources for the Future, Inc., 1971, pp. 312-44.

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Although competitive forces operate in determining the price of virtually all minerals, the markets are far from perfect and the world price structure tends to be quite complex.^{1/} Even where sales are not made to affiliates of the producing firm, trade relations between firms are often determined by considerations other than price and quality. Purchasers are often more concerned with the reliability of supply and the ability of sellers to make good on their contracts. Moreover, there is considerable differentiation in quality among ores (or concentrates) of the same mineral, and buyers differ in their preferences for one type or the other. Thus under conditions of imperfect competition and product differentiation, the "equilibrium price" is often difficult to discover or even to define.

The existence of vertical integration and imperfect competition, and the absence of a clearly defined equilibrium price for a mineral at a particular stage in processing may enable international mining firms to exercise considerable control over the prices of their products. Under these conditions, prices can be increased by sellers without an immediate and substantial loss of their market shares, as contrasted with the case under conditions of perfect competition. Also producers' costs may differ substantially; and a rise in costs for one group of producers, say, as a consequence of increased taxes, might lead them to pass on some of the higher costs to purchasers in the form of higher prices and to absorb the remainder. The high overhead costs in mining tend to inhibit a reduction in output in response to increased taxes, while the relatively inelastic demand faced by individual producers facilitates the raising of prices to compensate for increased costs.

The conditions described above are more likely to apply to private international mining firms than to nationalized mining enterprises in producing countries. Government mining enterprises lack worldwide marketing organizations

^{1/}See Garald Manners, The Changing World Market for Iron Ore, 1950-1980, Baltimore: Johns Hopkins Press for Resources for the Future, Inc., 1971; and Sterling Brubaker, Trends in the World Aluminum Industry, Baltimore: Johns Hopkins Press for Resources for the Future, Inc., 1967.

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and established relations with foreign purchasers. Even where private mining firms are not directly affiliated with processors and fabricators abroad, their market outlets are often based on the confidence of foreign purchasers in the standardized quality of their products and in their ability to meet delivery schedules under contracts.

In contrast, nationalized mining enterprises are often required to compete with one another and with private international firms solely on a price basis. For example, following the expropriation of Alcan's bauxite operations in 1973, Guyana had difficulty in finding markets for its metallurgical bauxite; and Chile has had difficulty in negotiating contracts on the basis of LME copper prices following the expropriation of the American copper companies. For these reasons, governments are in a better position to exercise control over the prices of their country's minerals when those minerals are sold by international firms operating their mines.^{1/} Such control can most readily be exercised by raising taxes on the foreign mining firms.

THE LESSONS OF OPEC^{2/}

The problem of determining prices of raw materials not sold on commodity exchanges as a basis for government revenues is well illustrated by the history of the international petroleum industry. Until a decade or so ago the prices at which crude oil was sold to refineries in areas of the world outside the United States were controlled by a handful of international petroleum firms. These firms employed various measures to limit the area of competition. The fact that

^{1/}This point has been made by Theodore H. Moran in an article titled "New Deal or Raw Deal in Raw Materials," Foreign Policy, No. 5, Winter 1971-72, pp. 119-34. John E. Tilton also points out that most sales of aluminum, bauxite, copper, lead, manganese, tin, and zinc are based on stronger and more dependable ties than mere price considerations: "The Choice of Trading Partners: An Analysis of International Trade in Aluminum, Bauxite, Copper, Lead, Manganese, Tin and Zinc," Yale Economic Essays, Fall 1966.

^{2/}Organization of Petroleum Exporting Countries.

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these firms refined and marketed the bulk of their own production rather than selling in competitive international markets enabled them to control the prices of crude petroleum on which their royalties and income tax payments were based. They generally limited competition by means of a basing point system and established so-called posted prices for various grades of crude oil in the countries where the crude was produced.

It was the reaction of the governments of the petroleum-producing countries to an attempt by the oil companies to reduce the artificially determined posted prices in 1959-60 that sparked OPEC's formation. The major function of OPEC is to assist members in establishing their own arbitrarily posted prices as a basis for tax revenues from the international petroleum companies. Thus, in the case of OPEC, control over world petroleum prices has been achieved, not through output restriction (until October 1973), but by putting a floor on international prices of crude oil via taxation of the international oil companies.

Recently this control was reinforced by participation agreements between the host governments and the producing companies. Under the agreements the host governments receive a certain portion of the crude output from the companies (sometimes related to the host government's share in the equity of the producing company), and then sell the petroleum back to the producing company at the posted price set by the government. In this way the governments of the oil-producing countries are relieved of any responsibility for marketing the output and of making contracts for the sale of crude oil. The international firms are in a position to pass on the increased taxes to consumers of the products of their downstream refineries and distribution outlets.

The OPEC experience suggests that where nonfuel mineral industries are vertically integrated or where the market for the product is imperfect, an increase in revenues of producer countries might be achieved by raising taxes on private international producing firms that are able to pass on the increased taxes to downstream affiliates.

But if one country increases its taxes on foreign investors, will not the international firm reduce output and investment in this country and shift production and investment to other countries where it may have producing

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facilities? This is, of course, what should happen, but the scenario is often quite different. When one country raises taxes on investors in an extractive industry, it frequently encourages others to follow. This has been the pattern in petroleum, and one of OPEC's important functions has been to prevent a country that takes the lead in raising taxes from losing output to other OPEC members.

The demonstration effect in taxation is evident in the international nonfuel mining industry as well as in petroleum. Also, governments have acquired sufficient control to prevent companies from reducing output in order to supply their affiliates from other sources. In some cases, host governments have succeeded in inducing companies to increase their investment in the face of increased taxes in order to avoid expropriation.

Finally, under conditions of imperfect competition, vertical integration, and expanding demand, a large international company that announces a rise in prices as a consequence of an increase in host government taxes often triggers a rise in prices by other companies. International companies frequently state that a threatened rise in their taxes will make it impossible for them to remain competitive in world markets. Very often the actual outcome is that the company succeeds in passing the taxes on to the consumers, provided its competitors are also faced with increased taxes. This is why Professor M. A. Adelman of the Massachusetts Institute of Technology has called the international oil companies the tax collectors for the OPEC members.

Professor Adelman has argued that if the international oil companies were forced out of their role as producers in the OPEC countries, petroleum prices would quickly fall toward the long-run marginal cost of crude, which he estimates to be about 20 cents per barrel.^{1/} This position has been challenged both by the oil companies and by other petroleum economists, such as James McKie.^{2/} They argue that, given the rapid growth in the world demand for petroleum (running

^{1/}See M. A. Adelman, The World Petroleum Market, Baltimore, Johns Hopkins Press for Resources for the Future, Inc., 1972.

^{2/}James W. McKie, "The Political Economy of World Petroleum," American Economic Review, May 1974, pp. 51-57.

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at about 8 percent per annum prior to October 1973), Saudi Arabia and a few other OPEC countries that are not in any hurry to increase their output in line with the growth of world demand are well able to maintain and possibly even to increase the present real price of crude petroleum. Moreover, so long as these countries believe they are operating on the inelastic portion of the demand curve, they can hold back production and still increase their revenues even though Iran and a few other OPEC countries might reap much larger benefits.

Even if we reject the Adelman hypothesis as applied to the nonfuel mineral industries and assume that producers' associations would be able to exercise direct market control by production, by export quotas, or by agreeing to maintain the price at a certain level, the prospects for success are far less promising than in the case of petroleum.

First, the world demand for nonfuel minerals has not been growing at anything like the rate of growth in demand for petroleum.

Second, nearly all the major nonfuel mineral producing countries in the developing world are urgently in need of foreign exchange income.

Third, the high overhead costs in the mining industry and the large debt service constrain producing countries from cutting back production.

Fourth, although there are readily available substitutes for most nonfuel minerals, in the case of petroleum a major expansion of energy substitutes may require decades.

Finally, there is a substantial difference in the distribution of world reserves of petroleum from that of most nonfuel minerals. The bulk of the known and probable reserves of petroleum is in the OPEC countries with a very heavy concentration in a few Middle Eastern countries. Reserves of most of the important nonfuel minerals are widely distributed around the world, and there is less concentration of reserves and productive capacity within the developing countries than in industrial countries.

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PRICE CONTROL IN THE ABSENCE OF VERTICAL INTEGRATION
AND MARKET IMPERFECTION

Where markets are reasonably competitive and the producing firms are not vertically integrated, producers' associations may not be able to influence prices by raising taxes on the private producing firms. If taxes are raised and not passed on to the consumers, the profits of the private companies will decline and they may not be able or willing to expand productive capacity or even to replace obsolescent or worn-out equipment and structures.

If the producers' association seeks to maintain an agreed-upon price by requiring that all contracts be negotiated at or above that price, those members whose production is in the hands of private international firms with superior marketing organizations or with downstream affiliates are likely to achieve a larger market share than members with nationalized industries and relatively poor marketing organizations. Purchasers may also prefer to negotiate contracts with international firms with several sources of supply rather than contracts with nationalized enterprises. Under these circumstances some members may soon accumulate surpluses or be forced to violate the price agreement by shading contract prices.

The alternative will be to establish production or export quotas. Reaching an agreement on quotas, however, is exceedingly difficult except for short periods of time because each member is anxious to maintain or expand output from existing capacity. In addition, developing countries with ample mineral reserves usually have plans underway for expanding their mine capacity. Although members of a producers' association have a common interest in maintaining or raising the price of their product, basically they are all in competition with one another for shares of the world market. Even the OPEC members have never been able to agree on export quotas, although the OPEC Secretariat has proposed such quotas. Likewise, suggestions for the establishment of export quotas by members of the Intergovernmental Council of Copper Exporting Countries (CIPEC) have not proved acceptable to some members.

Where commodity exchanges for products exist, members of a producers' association might establish a buffer stock arrangement for maintaining prices along the lines of the International Tin Agreement. However, buffer stocks are

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generally useful only to reduce the amplitude of price fluctuations. Continuous purchases for maintaining market prices above long-term equilibrium levels would require large financial outlays which most developing countries could not afford.^{1/} It has been rumored that OPEC members would be willing to finance large purchases of copper from the CIPEC countries in order to maintain high copper prices. Although such action is conceivable, thus far OPEC members have largely limited the investment of their reserves to assets which are both relatively liquid and provide a reasonably high yield.

MARKET SHARE, SUBSTITUTION, AND ELASTICITY OF DEMAND
FOR THE OUTPUT OF MEMBERS OF A
NONFUEL MINERALS PRODUCERS' ASSOCIATION

Regardless of the world market structure of a commodity and the ability of members of a producers' association to control prices over relatively short periods of time, the ability to sustain prices through collusive action over time is a function of:

- (a) the collective share of the world supply of the commodity controlled by the association;
- (b) the supply elasticity of the output of nonmember producers of the commodity; and
- (c) the price elasticity of world demand for the product.

^{1/}Although the International Monetary Fund (IMF) provides special financial assistance to members of the International Tin Council, the IMF is willing to finance only those buffer stock arrangements that include consumers as well as producers and have as their purpose the ironing out of price fluctuations above and below the estimated long-term equilibrium level.

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For example, the price elasticity of demand for copper produced by the CIPEC countries is a function of the price elasticity of world demand for all copper, the price elasticity of copper supply (including scrap) outside CIPEC, and CIPEC's share in total world supply.^{1/}

The price elasticity of world demand for a nonfuel mineral is in part a function of the elasticity of substitution between the nonfuel mineral and other commodities which serve as substitutes for the mineral in question and of the elasticity of supply of the substitute materials.

The above factors determine both the ability of a producers' association to control prices over a given period of time and the financial advantage of market controls to the producers' association. Although a producers' association controlling no more than, say, one-fourth of the world's supply of a mineral may be able to raise prices substantially in the short run, in the longer run the expansion of output by nonmembers of the association and by producers of substitutes will tend to drive down the price of the mineral in question.

Also, if the price elasticity of demand for the output of the producers' association members is greater than unity, total receipts will decline with a rise in prices, and association members will find that they are losing their

^{1/}We may express these relationships algebraically as follows:

$$E_{cp} = \frac{1}{m} \cdot E_{dw} - \frac{1}{m} \cdot (1-m) \cdot E_{srw}$$

where E_{cp} = price elasticity of demand for CIPEC's copper exports

E_{dw} = price elasticity of world demand for all copper

E_{srw} = price elasticity of copper supply outside CIPEC

m = CIPEC's share of total world supply

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share of the market in the effort to maintain prices. The change in the price elasticity of demand over time is in part a function of the time required for the adjustment of production to the use of substitutes; but in many cases, once substitute commodities are adopted for certain uses of a mineral, that market is lost for all time. For most nonfuel minerals, price elasticity of demand is likely to be less than unity in the short run but higher than unity in the longer run.

Where minerals have substitutes with reasonably high supply elasticities, producers are usually concerned about the relationship between the prices of their products and those of substitutes. CIPEC members are well aware of the possible effects of current high copper prices on the longer run world demand for their output since once substitutes come to be employed for copper in certain uses, that part of the demand usually cannot be regained.^{1/}

CIPEC has undertaken several studies of the price elasticity of demand for CIPEC copper, and it is perhaps significant that CIPEC's annual and quarterly reports contain charts on the ratio of world copper prices to the prices of aluminum. However, if through collusive action between CIPEC and the International Bauxite Association the prices of both minerals could be raised, there would be less impact on the longer run demand for both minerals.

Although rational conduct requires that producers pay close attention to the price elasticity of demand for their product, producers have not always been rational -- as evidenced by attempts on the part of private associations to raise and maintain high prices for their products. Moreover, in a world free of depressions and growing materials shortages, an increase in the world price of one commodity may induce a rise in the price of a close

^{1/} According to a World Bank study, the shortrun elasticity of world demand for CIPEC copper is sufficiently close to unity that CIPEC's ability to improve the export earnings of its members by an increase in prices is only marginal. According to this study the longrun elasticity of demand for CIPEC copper is significantly above unity.

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substitute, with the result that the producers of both commodities may gain without a permanent loss of a substantial portion of the market for either product.

SOME POLITICAL CONSIDERATIONS

In addition to the economic factors discussed above, one must take account of political factors in assessing possible actions among producers of nonfuel minerals. Clearly one of the strengths of OPEC has been the broad area of common interest among its members. Although Canada and Australia may well become members of some type of producers' association, they are unlikely to become members of any world organization that would seek to achieve more than reasonable price stability for a raw material. It is true that Canada put an export tax on its petroleum exports to the United States, but the alleged purpose was to bring the price of crude petroleum exports more in line with what Canada itself is paying for imported crude. Canada does not appear to be a likely prospect for membership in either OPEC or CIPEC.

The USSR, South Africa, Rhodesia, and Turkey produce the bulk of the world's chromium. They would be strange bedfellows, indeed, in an association designed to control the price of chromium. Moreover, given South Africa's political and economic orientation, it is unlikely to force up the world price of chromium by a special tax on chromium producers. Nor is South Africa likely to join with Gabon, Zaire, and Brazil in order to raise the price of manganese.

METHODS OF WORLD MARKET CONTROL

Methods of world market control which might be employed by governments of producer countries may be summarized as follows:

1. The OPEC formula. This requires the existence of international producing companies that deliver the bulk of their output to downstream affiliates. World prices can be raised by increasing taxes or by having the producer government take title to the product and then selling the product back to the producing companies at an arbitrary price for distribution to affiliates. A minimum of cooperation among the producer governments is required. One possible type of cooperation would be preventing the affiliates of a company operating in one country, whose

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taxes have been raised by more than are taxes in other producer countries, from shifting their source of supply to the lower tax countries. Another type of cooperation would be to establish more or less uniform levels of taxation by the producer countries.

2. Marketing by governments of producer countries at prices agreed on among members of the producers' association. If there are private producing companies, they may buy some of the output from the government marketing enterprise at the association price, or they may act as selling agents for the producer governments within the price guidelines. Where the private companies have affiliates (or a superior marketing organization), this would constitute an advantage to the producer country over producer countries that had completely nationalized their industry. If the latter countries began losing their share of the market, it would lead to price shading, special bilateral deals, etc., thereby endangering the viability of the price agreement.

3. Production or export quotas assigned to each producing country by the association. This approach creates serious difficulties in industries in which producer countries are in longrun competition for markets and are planning substantial increases in mining and processing capacities.

4. Buffer stock arrangements designed to control prices on organized exchange markets. This type of arrangement is best exemplified by the International Tin Agreement, and the problems of managing a buffer stock are well known. It is most useful when the objective is one of true price stabilization rather than an attempt to achieve a particular price objective.

POTENTIALITY FOR COLLUSIVE ACTION AMONG
PRODUCER COUNTRIES OF MAJOR WORLD MINERALS AND
POSSIBLE METHODS FOR ACHIEVING MARKET CONTROLS

The above discussion suggests that in considering both the potentialities for raising world prices of minerals by means of collusive action by the principal exporters and the methods for achieving market control, attention should be paid to the following:

a. The nature of the demand for the product, including the existence of substitute materials and the rate of growth of demand.

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b. The organization of the industry and the structure of the world market for the product.

c. The degree of concentration of productive capacity and reserves.

d. The political and economic orientation of the major world exporters of the product.

In the following discussion consideration will be given only to those nonfuel minerals that are important in world trade and where the interests of the United States might be directly or indirectly affected by collusive action to raise world prices. For example, molybdenum or phosphate rock,^{1/} of which the United States is a substantial exporter, will not be considered.

Copper

CIPEC's share of Free World copper production (including concentrates, blister, and refined) in 1972 was 38 percent, and CIPEC members accounted for 53 percent of copper exports in 1971. The addition of other large LDC (less developed countries) copper producers, such as Papua New Guinea (PNG) and the Philippines, to CIPEC membership would increase CIPEC's proportion of world exports to nearly two-thirds. In the CIPEC countries well over half of the production is in government hands, and marketing is almost wholly controlled by the government. Almost none of Chile's output goes to firms with an interest in Chilean production. A substantial proportion of Peruvian and Zambian output, however, goes to affiliates of international firms engaged in production in these countries. Nearly all of Zaire's output has been

^{1/}The ability of Morocco to triple the export price of phosphate rock within the past year or so has some interesting implications for world market controls. Morocco holds 73 percent of the Free World's known reserves of phosphate rock and is Western Europe's principal source of supply. Morocco is apparently in a position to control the world price without collusion with other exporters.

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marketed by a Belgian firm, SGM, which has a management contract with Zaire's nationalized copper industry (SGM is affiliated with European copper fabricators). A small portion of Zaire's output is produced by a Japanese firm which ships concentrates to its Japanese affiliates. The output of PNG and of the Philippines is exported in the form of concentrates under long-term agreements with Japanese and European firms with prices tied to the LME.

Clearly the CIPEC countries could exercise a strong influence on the world price of copper. However, their ability to employ the OPEC formula by influencing world prices simply by raising taxes on private producers is greatly limited because only a small portion of their output is taken by the affiliates of firms with substantial investment in CIPEC members. No CIPEC member is sufficiently dominant in the world market to begin to negotiate contracts, say, at a price significantly above the LME price. Conceivably in periods of shortage a price leadership role could be exercised with success, but the price leader is likely to lose its share of the market rapidly when surpluses at the controlled price begin to appear. Hence, CIPEC's opportunities for market control would depend upon the use of either production or export quotas or the employment of a buffer stock arrangement in an attempt to control the LME price.

For several years the CIPEC countries have been debating the question of what methods they should use in achieving some degree of world market control. Recently the high prices for copper in relation to aluminum have not only rendered collusive action unnecessary, but there has been some concern regarding the impact of the high prices on the longrun demand for copper.^{1/}

All four CIPEC members are anxious to expand productive capacity and output. The country with the largest undeveloped reserves, Peru, is producing only about one-fourth the amount produced by Chile or Zambia and is very anxious to double or

^{1/}Over the past decade the demand for copper outside the US has increased at a rate of about 6 percent per annum. However, this rate is expected to decline to about 4 percent over the next two decades.

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triple its productive capacity. This makes unlikely any long-term agreement on production or export quotas. CIPEC members are discussing the possibility of a buffer stock for controlling the LME price to which contracts for sales of their output have been tied. Another approach, of course, would be to reach periodic agreements on contract prices above the LME price, say, when the LME price declined below a certain level. Such an agreement, however, would be very difficult to police.

As has already been noted, CIPEC members are quite concerned with the relationship between the price of copper and that of copper's principal substitute, aluminum. Undoubtedly CIPEC would welcome a strong association in the aluminum industry which would raise prices of that commodity, and one could even envisage short-term agreements for maintaining a certain ratio of the prices of the two commodities.

Bauxite

Approximately 75 percent of the world's exports of bauxite and alumina is accounted for by the recently organized International Bauxite Association, comprising seven countries--Australia, Guinea, Guyana, Jamaica, Sierra Leone, Surinam, and Yugoslavia. Without Australia the six developing countries account for about 60 percent of world exports of bauxite and alumina. Except for Guyana, which recently nationalized the Alcan properties, production of bauxite and alumina is largely controlled by vertically integrated international firms. The vast bulk of the reserves and production of bauxite is in the developing countries plus Australia, while nearly all of the aluminum metal is produced in the developed countries. The rate of growth in US domestic demand is relatively high (7 percent), and the growth rate for the rest of the world has been considerably higher.

This industry presents perhaps the closest parallel to the OPEC situation. The governments of the producer countries might be able to force a rise in prices by raising taxes which the companies would pass on to the consumers. In May 1974 Jamaica proposed to raise taxes on the foreign companies by nearly eight-fold.^{1/} Jamaica accounts for

^{1/}See "Jamaica Proposes Bauxite Legislation to Produce \$200 Million Over 13 Months," Wall Street Journal, May 17, 1974, p. 3.

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about 30 percent of the world's exports of bauxite and alumina. Possibly with the assistance of similar tax demands on the part of some of the other producing countries, Jamaica might be able to achieve a several-fold rise in tax revenues without a significant loss of output.

There are, of course, important differences between bauxite and petroleum. There is a range of substitutes for aluminum, and most of the bauxite-producing countries are in great need of foreign exchange. On the demand side, four tons of bauxite at \$9 to \$15 per ton are needed to produce a ton of aluminum ingots selling at over \$600 per ton. By comparison, the value of a barrel of refinery petroleum products is ordinarily less than double the value of a barrel of crude. Thus, doubling the price of bauxite would increase the price of aluminum by less than 10 percent.

Tin

Four countries--Bolivia, Indonesia, Malaysia, and Thailand--account for 80 percent of the Free World production of tin and for a somewhat larger share of world exports of tin ore and metal. The industry is not concentrated in the hands of a few vertically integrated private companies as in the case of bauxite, and the principal measure of market control has been through the International Tin Agreement, which was designed to stabilize tin prices rather than to raise them well above the equilibrium level. A potential for raising prices through production and export quotas exists because of the high concentration of production in a few developing countries. However, the existence of the US stockpile and a wide range of substitutes for tin in its important uses make it likely that tin producers will continue to rely on the buffer stock for preventing sharp declines in tin prices, a mechanism which has the support of major consumer countries (excluding the US) and of the IMF.

Chromium

South Africa, Rhodesia, Turkey, the Philippines, and the USSR account for nearly 80 percent of world mine production of chromium and an even larger share of world exports. Although chromium is essential for many uses, and the

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short-term elasticity of demand is probably fairly low,^{1/} the structure of the industry and the differing political-economic orientation of the major exporters render the likelihood of collusion rather small. Nevertheless, if one of the major producers, say, South Africa, should take the initiative to raise prices (by putting a special tax on exporters), other producing countries might very well follow by raising prices. The United States is wholly dependent upon imports of chromium, and imports approximately equal the amounts from the USSR, South Africa, and Turkey. US domestic demand is growing at about 5 percent per annum.

Manganese

The world production and export of manganese ore is rather heavily concentrated in the USSR, South Africa, Brazil, Gabon, and India, with these countries accounting for more than 80 percent of world production, and a somewhat smaller percentage of world exports (since the USSR consumes a large portion of its output). World demand for manganese is probably rather inelastic since there is no satisfactory substitute for the metal as an input in steelmaking, its principal use. The bulk of US imports comes from subsidiaries of US steel firms, so that there exists the possibility of increased taxation which would be passed on to US consumers of steel.

Despite its geographical concentration, the diverse political orientation of the major producers would make effective collusion difficult. Output control would be difficult because much of the manganese is produced as a byproduct of iron and other metals. The United States is dependent upon foreign sources for about 95 percent of its consumption, and the bulk of its imports come from Gabon, Brazil, South Africa, and Zaire. US domestic demand is growing at only 3 percent per annum.

Cobalt

World production and exports of cobalt are dominated by Zaire. Like manganese and chromium, cobalt is used in the production of steel and in certain chemical products. However, nickel can be substituted for cobalt in many uses.

^{1/}Since most ferroalloys are substitutes for one another, longrun demand is probably fairly elastic.

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As a byproduct of copper in Zaire and in other countries, the supply of cobalt is inelastic. Moreover, there are very large reserves of cobalt in Canada, New Caledonia, and Australia, and an attempt to maintain very high prices for cobalt would probably result in substantial expansion of sources outside of Zaire.

Iron Ore

Iron ore production and reserves are rather widely distributed around the world among both developed and developing countries. Although some of the production is controlled by vertically integrated international firms, as in the case of Canada, Brazil, Liberia, and Venezuela,^{1/} much of the world's output in the developing countries has been nationalized. The absence of concentration of reserves, production, and exports, and the wide differences in political orientation of the major exporting countries would make effective collusion quite difficult. The United States is currently dependent on foreign sources for about 30 percent of its iron ore requirements, and this dependence will increase over the coming decades. However, the United States could supply its own requirements with lower grade ores. Despite the production of iron ore by vertically integrated firms, world output and reserves are too well dispersed to enable any likely grouping of foreign suppliers to achieve effective market control.

Lead and Zinc

The United States has the world's largest reserves and the largest output of lead; it also has large reserves of zinc and is the world's second largest producer. Although the United States is expected to be increasingly dependent upon foreign supplies for both lead and zinc, most of its imports will probably continue to come from Canada, with smaller amounts coming from Australia and the Latin American countries. Forward integration in the industry outside the

^{1/}The new Venezuelan Government has recently announced its intention to nationalize the Venezuelan iron ore industry currently controlled by US Steel and Bethlehem Steel.

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United States is not substantial. On the whole, the world market structure does not appear to be conducive to collusion for market control.

Other minerals

The United States is heavily dependent upon foreign sources of nickel, potash, tungsten, and mercury, and will become increasingly dependent on foreign sources of sulphur. Currently Canada is the major source of US imports for all of these minerals, and in most cases collusive action among world producers would probably require Canada's cooperation.

CONCLUSION

The best candidate for world market control by means of OPEC-type action is bauxite. However, even a substantial rise in taxes on bauxite producers is unlikely to cause significant injury to the aluminum industry in the United States. Collusive action for raising copper prices is a real possibility, but the financial position of the CIPEC members precludes their ability to restrict exports over long periods or to accumulate large stocks of copper. The threat would be more serious if collusive action involved producers of both bauxite and copper.

For most other commodities, there appear to be political barriers to effective collusion and, in many commodities, the inclusion of Canada in the collusive association would probably be essential. In any case, significant harm to the US economy could be avoided by a stockpile equivalent to 1 or 2 years' import requirements because successful market control by means of collusive action by producers' associations over longer periods of time does not appear to be feasible.

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SELECTED COMMODITIES OF WHICH 20 PERCENT OR MORE OF US REQUIREMENTS
ARE CURRENTLY SUPPLIED OR ARE LIKELY TO BE SUPPLIED BY IMPORTS BY 1980

<u>Commodity</u>	<u>Major Sources of US Imports in 1972</u>	<u>Over One-Third US Imports From LDCs</u>	<u>Over One-Half US Imports From LDCs</u>	<u>Projected Rate of Growth of US Demand (percent)</u>	<u>Net Imports as Percent of Domestic Use - 1970 (percent)</u>
Bauxite-alumina	Jamaica, Surinam, Canada, Australia	x	x	7	86
Chromium	South Africa, USSR, Turkey	x		5	100
Cobalt	Zaire, Zambia, Norway, Finland	x	x	2	96
Copper	Canada, Peru, Chile	x	x	4-5	8
Iron ore	Canada, Venezuela	x		1.5-2.5	30
Lead	Canada, Australia, Peru, Mexico	x		1.6	40
Manganese	Brazil, Gabon, South Africa, Zaire	x	x	3	94
Nickel	Canada, Norway			3	91
Potash	Canada			4	42
Sulphur	Canada, Mexico			4	0
Tin	Malaysia, Thailand, Bolivia	x	x	4	71
Tungsten	Canada, Bolivia, Peru, Australia, Thailand	x		8	50
Zinc	Canada, Mexico, Peru			3	59

SOURCE: Mining and Minerals Policy, 1973 (Second Annual Report of the Secretary of the Interior Under the Mining and Minerals Policy Act of 1970), USGPO, 1973; and Material Needs and the Environment, Today and Tomorrow, National Commission on Materials Policy, USGPO, 1973.